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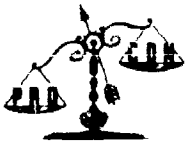

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McLEAN, VIRGINIA

FOREWORD

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Military Cost Analysis

Under the influence of Secretary McNamara, it has become an established practice in the Defense Department to support major program decisionmaking with systematic analyses of possible program choices in terms of their military worth and costs. This does not diminish the role of the decisionmaker in evaluating the analyses, assessing the nonquantitative aspects, and applying value judgments, but it does provide a basically rational framework for decisionmaking, one that fosters the imaginative generation of likely alternatives.

The relating of military worth and costs requires an objective expression of the military capability afforded by a given program. This expression may be accomplished in several ways; one or another may be more convenient in a particular problem.

The most common method is to specify a military task to be accomplished, and then determine alternative forces, weapons, and manpower of equal capability required to accomplish the task. The alternative military means for accomplishing the same task are then compared in terms of their costs.

Another method is to assume a certain cost level, and then determine how much of each alternative force can be secured at that level. Capabilities of the alternative forces are then compared in terms of their potential outputs (e.g., targets destroyed) or in terms of each of their major characteristics deemed pertinent by military planners.

Where it is not possible to relate the alternatives in terms either of equal effectiveness or equal cost, the analysis must relate the alternatives in terms of different degrees of effectiveness and cost.

This very abbreviated description of how costs are related to military worth glosses over many problems in the determination of military worth. What if there are a variety of tasks to be performed by a military force or weapon system, how do we accord each its due? What if two weapon systems are not exactly comparable in all their possible uses? How do we allow for the elements of a problem that do not lend themselves to quantification?

The measurement of military worth is a big subject in itself—one of primary concern to the practitioners of systems analyses of the kind we have been describing. Our present concern, however, is with the cost estimates to which the military worth will be related.

Military cost estimates are made through application of the techniques of military cost analysis. Why the differentiation between estimates and analysis? Military cost analysis involves a thorough understanding of the structuring of systems analyses, the use of appropriate cost categories, discrimination between relevant and irrelevant cost elements, consideration of uncertainties, and application of cost-sensitivity analyses.

More broadly, these are the elements of military cost analysis:

1. Emphasis on total program cost, to include the entire stream of cost consequences over the life of the program. The costs usually relate to peacetime preparation for war rather than to the consumption of resources in wartime, but in certain cases, it is reasonable to include costs of wartime consumption for a portion of the life of the system. In general, such wartime costs are excluded for strategic systems but are sometimes introduced for limited war and sublimited war systems.

2. Use of cost categories such as research and development, investment, and operating, which highlight the major phases in the life cycle.

3. Consideration not only of total program cost but also of the timing of costs. Involved here is the discounting problem and the importance in governmental programs of budgetary constraints by year.

4. Exclusion of "sunk" costs as a consideration in decisionmaking relative to program choices.

5. Costing of only the net resource requirements in a program (allowing thereby for inheritances of manpower or equipment or any other application of already available resources). A new weapon system can be costed through cost comparisons of two forces; one is the force excluding the weapon system under study, and the other is the force including the weapon system. For use in such comparisons and for use in studies comparing alternative force mixes and deployments, force cost models have been devised. Such models systematically develop all categories of cost comprised in a force.

6. Emphasis on costs of relative rather than absolute accuracy, in consonance with the primary utilization of such costs in the comparison of alternatives.

7. Recognition of the uncertainties inherent in the specification and costing of future force mixes and weapon systems, especially in areas of advanced technology. To attain the utmost in capability and to avoid rapid obsolescence, many weapon system programs aim at achieving major improvements in key performance characteristics over their predecessors. Technical risks are taken for which there are few parallels in nondefense programs. Such risks result in some cases in outright program failures, but more often in completed programs that depart to a greater or lesser degree from the anticipated time schedules, performance characteristics, or costs of the weapon systems. Case histories of missile and other advanced programs have indicated how substantial the discrepancies between actual and anticipated costs can be.

8. As a generalization, the core of the costing problem is the development of the specification of what is to be costed; the actual application of cost factors is the less difficult part of the problem. The military cost analyst plays a useful role in the specification process, particularly in regard to ferreting out all the resources to be required by a program. Since total program cost is the objective, it is necessary to include all the supporting forces, related procurement items, special training requirements, etc., implicit in the adoption of the force or weapon system. Especially in the area of operating costs is it important for systems analysts concerned with the overall study not to neglect some of the less obvious resource implications.

9. An important part of costing is the application of estimating relations to transform the specification of the ingredients of the force or system in its

proper time-phasing into a cost estimate. Estimating relations are used in such areas as the development of estimates for maintenance workload or training requirements consequent on the use of major items of equipment, and in the translation of workloads to costs. The cost-quantity curve is a particular kind of estimating relation in which hardware production costs are related to quantity and rate of production. A specific cost estimate may require the use of many relations, most of which are developed and accumulated over time to be available when needed. A substantial cost-estimating research investment is required for the maintenance of a costing capability.

This brief description of military cost analysis should be sufficient to indicate the differences in emphases from the conventional Defense budgeting process. Among the most important differences are: concern in military cost analysis with a force or weapon system rather than with a budget category such as aircraft procurement or depot supply; collection of all costs pertaining to the force or weapon for an extended period of time as against costing for 1 year; and emphasis on relative rather than absolute accuracy. The budget system highlights categories useful for control of spending (e.g., a military personnel appropriation); administrative aspects receive important attention. Military cost analysis is aimed at providing insight on cost implications of alternative courses of action.

These differences are of sufficient magnitude to explain why military cost analysis was developed outside the Defense Department itself, principally at the RAND Corporation.

Military cost analysis has not, however, remained independent of the administrative machinery of the Defense Department. Recognition of the importance of more closely relating the major outputs of defense activity (forces and weapon systems) with resource inputs has led Secretary McNamara to adopt a formal programming system with many characteristics derived from military cost analysis experience.

Chief elements of the programming system are a Defense Department 5-year force structure and financial program (in annual obligational authority) expressed in terms of such programs as strategic retaliatory forces and general purpose forces, and such program elements as B-52 squadrons and Marine Corps division/wing teams; and systematic review of possible program changes using the systems analysis techniques described above.

The programming system is viewed by top management of the Defense Department as the essential link between military planning and budgeting. Mr. Hitch, the Defense Comptroller who had a key role in initiating the programming system, justified this view in these terms: "The job of economizing, which some would delegate to budgeteers and comptrollers, cannot be distinguished from the whole task of making military decisions."

When comptroller he set the goal of integrating the three related phases of the decisionmaking process into a single planning-programming-budget system.

The adoption of the programming system has given new stature to military cost analysis. Total program costing as an aid to major decisionmaking is now a fairly well-accepted practice in the military departments.

The growing importance of military cost analysis resulting from its diffusion through the programming process has led to greater concern with the validity of the data going into cost estimates. The Defense Comptroller has

spearheaded efforts to secure more cost information from contractors and to develop more data within the Defense Department on all aspects of military costs, particularly those relevant to the newer programs. Such efforts have been formalized in a cost and economic information system, which also includes collection of economic information as a basis for analysis of economic impact of procurement by industry and geographic area.

Significantly the military departments are required under this system to establish cost analysis offices to organize and manage the program; to ensure the validity, comparability, and timeliness of actual cost and related data obtained from contractors; to develop techniques for cost estimating and analysis; to provide a central data storage and retrieval point; to disseminate cost analyses; and to coordinate data and classifications.

Through the establishment of this system, at least a beginning is made toward professional identification of the Defense cost analyst as a counterpart to the group of analysts who have been engaged in this activity in such organizations as RAND and the Research Analysis Corporation.

The adoption of the programming process is advancing military cost analysis in still another way. The frequency and volume of data required of the military departments have turned their attention to automatic data processing as a means of making the job manageable. The computer has been applied to many aspects of data preparation and processing. This has furthered orderliness and accuracy in the preparation and updating of basic military data files and has made these files more accessible to military cost analysts.

As the military departments extend the application of computers to costing in the programming process, they come closer to comprehensive force cost models, i.e., systems of relations and data from which are computed the time-phased resource and cost requirements for the equipping and operating of a force.

Such force cost models for programming will be similar to earlier force cost models for the comparative costing of alternative programs, but will retain some points of difference:

First, whereas the comparative cost model is aimed at the identification of the time-phased incremental costs of an alternative program (as compared to the base program), the programming cost model will be aimed at achieving fairly accurate costing of a single official program.

Second, whereas in the comparative cost model any breakdown of the time-phased incremental cost stream into major program and program element costs is for incidental and secondary purposes, such breakdowns are intrinsic to the purposes of the programming cost model. As a result, problems of joint cost allocation must be faced squarely and solved in the programming cost models.

Although military cost analysis has generally gained from the establishment of the programming process in the Defense Department, there is a danger in the formalization attendant on an administrative process. Interacting to the extent that it does with programming, military cost analysis may find itself unduly influenced toward structuring problems in terms of the classifications of major programs and program elements and the cost categories and 5-year periods used by Defense. The efficient use of military cost analysis in studies supporting major decisionmaking requires that military cost analysis remain free to use other classification systems and time horizons when required by the problem under consideration.

In the last 10 years military cost analysis has come a long way—it has achieved a significant role in military decisionmaking. It is all the more important, as a consequence, that every effort be made to advance the state of the art and that programs of improvement be actively pursued in problem areas.

There is of course the perennial problem of improving the accuracy of cost estimates. This requires a better understanding of the technology of the systems under study, and of the degrees or risk involved in achieving the desired physical and performance characteristics. The cost analyst cannot simply accept stated physical characteristics but must also inquire into the cost experience in other systems in achieving similar performance characteristics. Research on costs in direct relation to performance characteristics is needed for this purpose. Analysts working in areas of advanced technology must devote a considerable proportion of their time to this objective.

A greater effort must be made to convey, along with the cost figures, an understanding of their possible limitations in accuracy. This involves explicit identification by the analyst of the areas of greatest uncertainty, and the exploration of ranges of possible costs for the components or other elements in such areas. Presentation to the decisionmaker of ranges of costs (and their probabilities where these can be estimated) will afford him a more realistic basis for assessment.

More explicit treatment of uncertainties is particularly helpful when cost differences among alternatives are relatively small and do not really afford a reliable basis for selection.

The degree of technological risk-taking varies from time to time, in consonance with international developments and our position relative to our adversaries. In a period of high risk-taking, cost estimates will obviously be less accurate. In a period of low risk-taking there will be wider application of the program-definition phase and other measures to achieve tighter control over procurement. The quality of cost analysis cannot help but reflect these changes in climate.

Military cost analysis is not living up to its potentialties if its role is merely to furnish estimates for alternatives designated by the decisionmaker or the systems analyst. A more creative role is generally possible. Through ... mate association with the problem and insight into the contributions to cost of the various program elements, the cost analyst is often in a position to generate additional alternatives worthy of consideration. A technique useful toward this end is the performance of cost-sensitivity analyses to determine the effect on overall costs of variations in key elements or parameters. Facility in making such cost-sensitivity analyses is aided by computer application.

Aimed as it is at future costs, military cost analysis tends to be largely dollar-oriented. Total program cost is regarded as the common denominator in comparisons of programs; the real resources of manpower, materiel, and facilities are addressed primarily to get at their dollar-cost implications.

In the real world, however, a dollar spent with industry may have significantly different effects than a dollar spent to maintain a man in uniform. The categorization of costs as research and development, investment, and operating helps to a degree in discriminating the real resources; it is not, however, the equivalent of an explicit statement of the real resources involved

The concern with real resources is one of the major determinants of the present appropriation and budget structure, which highlights research and development, procurement, construction, military personnel, and operation and maintenance. Not only is the overall level of the budget of concern to Congress and the Administration, but the distribution by appropriation. Certainly the number of men in uniform is subject to control along with dollars.

It is precisely in reaction to compartmentalization in these terms that military cost analysis owes its origin. Total program cost in all appropriations is the orientation of military cost analysis. It is therefore understandable that military cost analysis would have a high regard for the common denominator, the dollar.

The partiality of military cost analysis for dollar measurement may lead to an underemphasis on real resources in the process of Defense decisionmaking.

The mix of real resources has economic and social implications to which the decisionmaker cannot be insensitive. Manpower induction and civilian unemployment are very human results of defense programming and procurement practices. Recognition of the need for a better understanding of the economic consequences of defense programs is responsible for the establishment by Defense of the Cost and Economic Information System as against simply a Cost Information System. The economic information objective is to collect and analyze employment and related economic impact data, by geographic area and industry.

Adding to the complexity is the need to consider the gold flow consequences in programs involving foreign procurements or deployments. In many cases this imposes a dual measurement requirement.

It is important that military cost analysis be broad enough to encompass the entire scope of resource considerations, so that the decisionmaker can determine on a more objective basis the economic implications involved in the alternatives.